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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/624,384	07/22/2003	Alexander Leybovich	020324 227P2	6818

33805 7590 01/05/2007  
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CLEVELAND, OH 44131

EXAMINER
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MCDONALD, RODNEY GLENN

ART UNIT	PAPER NUMBER
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1753

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/05/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

# Office Action Summary

Application No.

10/624,384

Applicant(s)

LEYBOVICH, ALEXANDER

Examiner

Rodney G. McDonald

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 12 October 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-12 and 14-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-12 and 14-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-10, 12, 14, 15, 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Albertinetti et al. "Granularity in ion-beam-sputtered TiO<sub>2</sub> films" Applied Optics, Vol. 35, No. 28, October 1, 1996 in view of Katsube et al. (U.S. Pat. 5,296,122) and McCaughan et al. (U.S. Pat. 3,757,119).

Regarding claim 1, Albertinetti et al. teach a method for forming a low-k dielectric material (i.e. silicon dioxide) on a substrate using PVD. The steps comprise using a Kaufman ion source to form an ion beam of Ar. The ion beam is converted into a beam of neutrals utilizing a plasma bridge neutralizer or hollow cathode neutralizer. The beam of neutrals is directed at a target of fused quartz and is exposed to the beam for bombardment. The target is sputtered to deposit on substrate mirrors. In the ion beam system there can be a certain degree of thermalization. (See pages 5620, 5621, 5624)

Regarding claim 2, the target comprises a low-k dielectric material of fused quartz. (See page 5621)

Regarding claim 4, the low-k dielectric material is inorganic silicon dioxide.  
(Page 5620)

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Regarding claim 5, silicon dioxide inherently has a dielectric constant of about 3.7. (See Evidence document of Saito et al. U.S. Pat. 4,734,340 Column 1 lines 21-23)

Regarding claim 6, Albertinetti et al. teach a system for physical vapor deposition of dielectric material onto a substrate comprising a sputtering target of quartz, a low energy, large aperture ion source of energized monochromatic ions (i.e. Kaufman-type ion gun), an ion optic system for equalizing, shaping and directing the ions into an ion beam (i.e. a grid pattern), a charge transfer system is present for neutralizing the beam (i.e. plasma bridge neutralizer or hollow cathode neutralizer), the means for directing the beam of naturals (i.e. the plasma bridge neutralizer), means for forming a thermalized cloud of sputtered particles (i.e. the pump) and means for depositing the cloud of sputtered particles (i.e. the planetary and the substrate). (See Page 5620, 5621, 5624)

Regarding claim 7, the target comprises a low-k dielectric material of fused quartz. (See page 5621)

Regarding claim 9, the low-k dielectric material is inorganic silicon dioxide. (Page 5620)

Regarding claims 10 and 12, the ion beam is passed through a charge transfer chamber of a plasma bridge neutralizer or hollow cathode neutralizer. Oxygen has been bled into the chamber and therefore the plasma bridge neutralizer or hollow cathode would contain a volume of slower moving neutrally charged gas atoms or molecules which move slower relative to the ion beam. (See Page 5621)

Regarding claims 14 and 15, Albertinetti et al. is discussed above and applies to claims 14 and 15. It is also believed that Albertinetti et al. inherently teaches the formation of the cloud wherein the cloud is formed by increasing the number of collisions between gas molecules and sputtered particles to decrease the directional momentum of the sputtered particles as they propagate toward the substrate. As pointed out already Albertinetti et al. teaches that in their ion beam system there can be a certain degree of thermalization. This thermalization is related to pressure which causes the effects applicant claims.

Regarding claim 17, the target can be quartz which is silica and is considered naturally porous. (See Page 5621)

The differences between Albertinetti et al. and the present claims are that the use of a beam of neutrals for sputtering is not discussed, the passing of the beam through a charge transfer chamber having slower moving gas atoms with respect to the fast moving ion beam for acquiring electrons is not discussed (Claims 1, 6, 15), the low-k dielectric materials being organic is not discussed (Claims 3, 8), and the target free of target surface charge compensation is not discussed (Claims 18-20)

Regarding the use of a beam of neutrals for sputtering, Katsube et al. teach that for sputtering a beam of neutrals can be used for sputtering. (Column 3 lines 39-62)

Regarding the target free of target surface charge compensation (Claims 18-20), Katsube et al. teach in Fig. 1 a target with no target surface charge compensation. (See Fig. 1)

The motivation for utilizing a sputtering beam of neutrals is that it allows for preventing chargeup, discharge or decomposition. (Column 4 lines 2-4)

Regarding ion beam sputtering of an organic material, Katsube et al. teach ion beam sputtering an organic material to form a polytetrafluoroethylene on a substrate. (See Katsube et al. Embodiment 2 and Experiment 2)

The motivation for forming an organic low-k dielectric material is that it allows for production of a MIM element. (See Katsube et al. Embodiment 2 and Experiment 2)

Regarding the passing of the beam through a charge transfer chamber having slower moving gas atoms with respect to the fast moving ion beam for acquiring electrons (Claims 1, 6, 15), McCaughan et al. teach that sputtering of material comprises generating an ion beam 13 from an ion source 10, focusing the beam 13 and directing the beam through a charge exchange chamber 14 and deflector plates 15 and through an apertured partition 16 into a collision chamber 17 where the sample 18 is sputtered. (Column 2 lines 59-67) The charge exchange chamber 14 and deflecting plates 15 may be used to form a neutral particle beam wherein a portion of the beam 13 is neutralized by charge exchange with a gas admitted to the chamber through port 14a and the non-neutralized portion is deflected from the beam path by plates 15. (Column 3 lines 40-54) Rare gases such as Ar can be used. (Column 3 lines 31-39) (It is noted that since the gas atoms are not accelerated like the ion beam that the gas atoms will be moving slower relative to the ion beam. The charge transfer is the equivalent of acquiring the electrons from the gas.)

The motivation for utilizing a charge transfer chamber having slower moving gas atoms with respect to the fast moving ion beam is that it allows for neutralizing the ion beam. (Column 3 lines 40-54)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Albertinetti et al. by utilizing a beam of neutrals for sputtering and utilizing a target of low k organic material for forming a film of low k material as taught by Katsube et al. and to have utilized a charge transfer chamber having slower moving gas atoms with respect to the fast moving ion beam as taught by McCaughan et al. because it allows for preventing chargeup, discharge or decomposition, for forming a MIM element and for neutralizing an ion beam.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Albertinetti et al. in view of Katsube et al. and McCaughan et al. as applied to claim 1 above, and further in view of Saito et al. (U.S. Pat. 4,734,340).

The difference not yet discussed is that the dielectric constant of the inorganic material is not discussed.

Regarding the dielectric constant of the inorganic material, Saito et al. teach that the dielectric constant of silicon dioxide is about 3.7. (Column 1 lines 21-23) Silicon dioxide has a low dielectric constant when sputtered. (Column 5 lines 17-23)

The motivation for sputtering a film of low dielectric constant is that it allows for producing films for mirrors. (See Albertinetti et al.)

Therefore, it would have been obvious to form a low dielectric layer of silicon dioxide having a dielectric constant of about 3.7 as taught by Saito et al. because it allows producing films for mirrors.

Claim 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Albertinetti et al. in view of Katsube et al. and McCaughan et al. as applied to claims 1, 10 above, and further in view of Harper et al. "Technology and applications of broad-beam ion sources used in sputtering. Part II Applications", J. Vac. Sci. Technol., 21(3), Sept./Oct. 1982 pp. 737-756.

The difference not yet discussed is that the ion energy of the ion beam is not discussed.

Regarding the energy of the ion beam, Harper et al. recognize that for sputtering the optimal energy range of 300-500 eV can be used. (See Page 739)

The motivation for utilizing an ion beam in the energy range of 300-500 eV is that it maximizes the material for removal. (See Page 739)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Albertinetti et al. by utilizing an energy range of 300-500 eV as taught by Harper et al. because it allows for maximizing material removal.

Claims 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Albertinetti et al. in view of Katsube et al. and McCaughan et al. as applied to claim 1 above, and further in view of Mattox, "Handbook of Physical Vapor Deposition (PVD)



Processing – Film Formation, Adhesion, Surface Preparation and Contamination Control”, pp. 344, 385, 1998.

The difference not yet discussed is that forming the cloud by increasing the number of collisions between gas molecules and sputtered particles to decrease directional momentum of the sputtered particles as they propagate toward the substrate is not discussed.

Regarding forming the cloud by increasing the number of collisions between gas molecules and sputtered particles to decrease directional momentum of the sputtered particles as they propagate toward the substrate, Albertinetti et al. discussed above teaches the thermalization which is inherently caused by gas collisions. (See Albertinetti et al. discussed above) Mattox teaches that sputtering can be considered to be ion beam sputtering and that at higher pressures of gas phase collisions occur and cause thermalization. (See Mattox page 344) Mattox further goes on to state that pressure will determine the thermalization of energetic particles in the system. (See Mattox Page 385)

The motivation for forming the cloud by increasing the number of collisions between the gas molecules and sputtered particles to decrease directional momentum of the sputtered particles as they propagate toward the substrate is that it allows for deposition of films. (See Mattox page 344)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have formed a cloud of thermalized particles as taught by Albertinetti et al. and Mattox because it allows for deposition of films.

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Albertinetti et al. in view Katsube et al. and McCaughan et al. and further in view of Mattox as applied to claims 1, 14 and 15 above, and further in view of Harper et al. "Technology and applications of broad-beam ion sources used in sputtering. Part II Applications", J. Vac. Sci. Technol., 21(3), Sept./Oct. 1982 pp. 737-756.

The differences not yet discussed is the ion beam energy.

Regarding the energy of the ion beam, Harper et al. recognize that for sputtering the optimal energy range of 300-500 eV can be used. (See Page 739)

The motivation for utilizing an ion beam in the energy range of 300-500 eV is that it maximizes the material for removal. (See Page 739)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized an energy range of 300-500 eV as taught by Harper et al. because it allows for maximizing material removal.

### ***Response to Arguments***

Applicant's arguments filed October 12, 2006 have been fully considered but they are not persuasive.

In response to the argument that Albertinetti et al. do not teach converting an ion beam into an energized monochromatic beam of neutrals but instead teaches creating a neutral space charge of ions which maintain their original charge, it is argued that the plasma beam neutralizer or hollow cathode neutralizer would act to neutralize the ions since electrons are being injected into the plasma. Even if Albertinetti et al. do not teach producing the neutral beam Katsube et al. teach utilizing a neutral beam for

sputtering a target. Thermalization resulting from the pressure selected during the sputtering. Albertinetti et al. teach selecting the appropriate pressure for thermalization. Furthermore, McCaughan et al. shows a charge transfer chamber having slower moving gas atoms with respect to the fast moving ion beam for neutralizing an ion beam which would be required by Katsube et al. to produce the neutral beam. (See Albertinetti et al., Katsube et al. and McCaughan et al. discussed above)

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

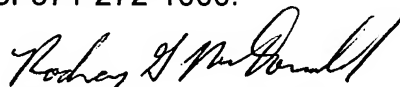
A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Rodney G. McDonald  
Primary Examiner  
Art Unit 1753

RM  
January 3, 2007